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(54) **MOBILE DEVICE MOUNTING SYSTEM AND METHOD**

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|                |         |                                          |
|----------------|---------|------------------------------------------|
| 6,646,866 B2   | 11/2003 | Kao                                      |
| 6,697,251 B1   | 2/2004  | Aisenberg                                |
| 6,788,528 B2   | 9/2004  | Enners et al.                            |
| 7,040,697 B1 * | 5/2006  | Tuccinardi ..... B60R 11/0235 297/188.04 |
| 7,197,584 B2   | 3/2007  | Huber et al.                             |
| 7,269,002 B1   | 9/2007  | Turner et al.                            |
| D582,149 S     | 12/2008 | Tan                                      |
| D592,189 S     | 5/2009  | Corsini et al.                           |
| D606,305 S     | 12/2009 | Lee et al.                               |
| 7,907,394 B2   | 3/2011  | Richardson                               |
| D637,596 S     | 5/2011  | Akana et al.                             |

(Continued)

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#### FOREIGN PATENT DOCUMENTS

|    |             |        |
|----|-------------|--------|
| CN | 201842027 U | 5/2011 |
| EP | 2608493 A1  | 6/2013 |

#### OTHER PUBLICATIONS

Shoemaker, Natalie, "Dock and More—The Omnio WOW-Keys keyboard gives you a reason to dock your iPhone," PCMag.com, Jun. 2, 2011.

(Continued)

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CPC ..... **F16M 11/041** (2013.01)

(58) **Field of Classification Search**  
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See application file for complete search history.

#### (56) References Cited

##### U.S. PATENT DOCUMENTS

|              |         |                  |
|--------------|---------|------------------|
| 5,253,292 A  | 10/1993 | Fluder et al.    |
| 5,436,792 A  | 7/1995  | Leman et al.     |
| 5,664,228 A  | 9/1997  | Mital            |
| 5,737,183 A  | 4/1998  | Kobayashi et al. |
| 5,850,954 A  | 12/1998 | Dong-Joo         |
| 5,948,047 A  | 9/1999  | Jenkins et al.   |
| 5,996,956 A  | 12/1999 | Shawver          |
| 6,231,371 B1 | 5/2001  | Helot            |
| 6,473,302 B1 | 10/2002 | Korycan et al.   |
| 6,538,880 B1 | 3/2003  | Kamijo et al.    |

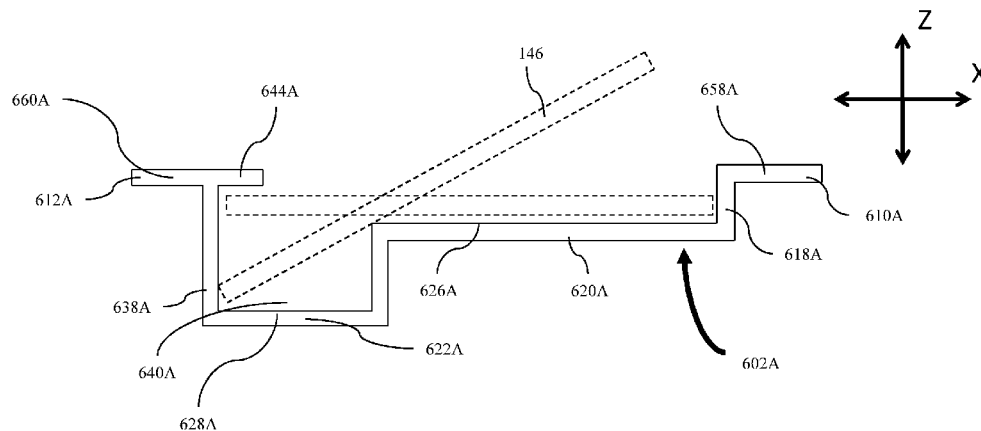
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#### (57) ABSTRACT

In an embodiment, a mobile device mounting system configured to hold a mobile device having a magnetic edge includes a magnetic support, a rest support, and a receiving section. The rest support is mechanically coupled to the magnetic support and has a first support surface that contacts a first contact surface on a rear side of the mobile device when the mobile device is moved downward to be held by the mobile device mounting system for viewing. The receiving section defines a recessed area configured to receive a part of the mobile device when the mobile device is angled such that the magnetic edge of the mobile device is separated from the magnetic support for user extraction.

**6 Claims, 16 Drawing Sheets**



(56)

**References Cited**

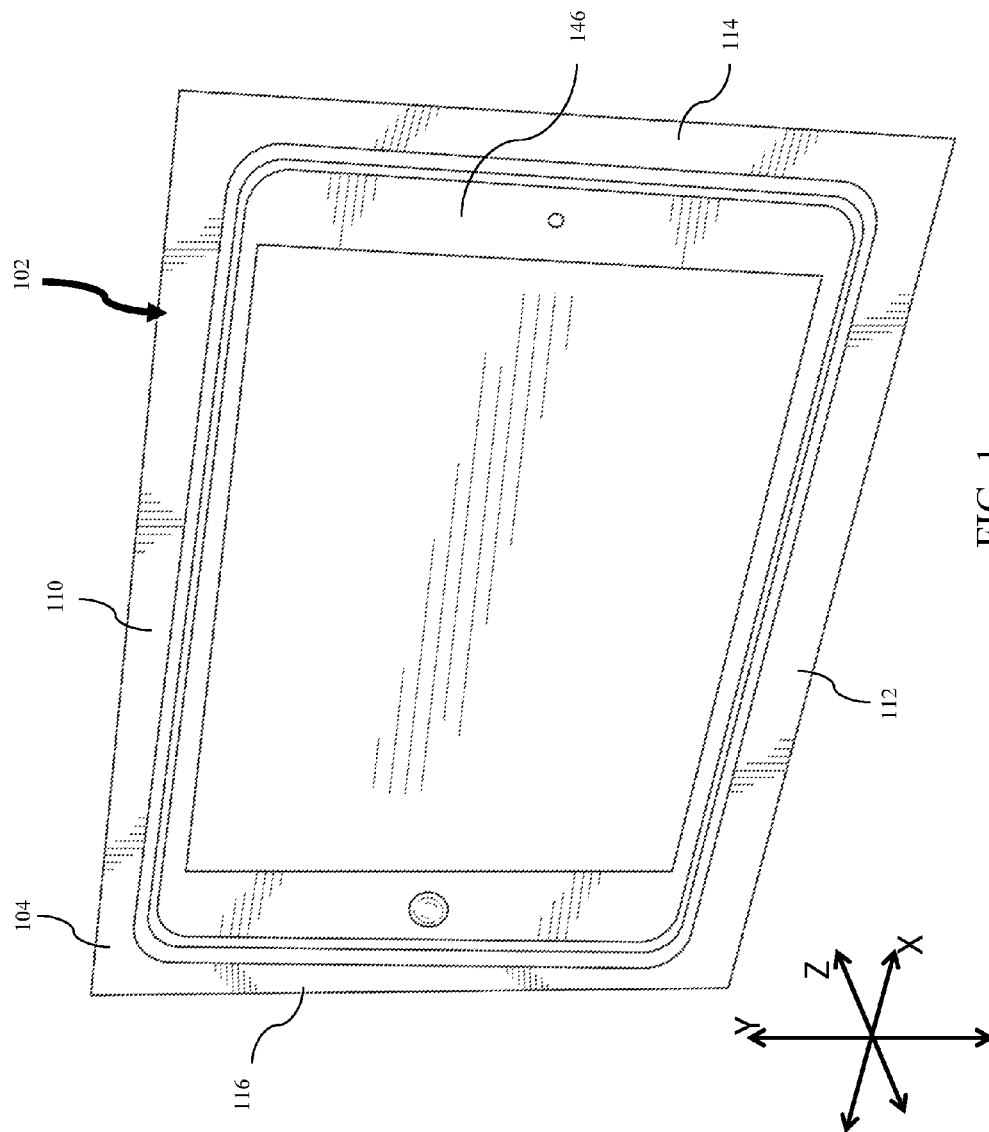
## U.S. PATENT DOCUMENTS

|           |      |         |                      |              |      |         |                          |
|-----------|------|---------|----------------------|--------------|------|---------|--------------------------|
| D644,229  | S    | 8/2011  | Corsini et al.       | 8,749,363    | B2   | 6/2014  | Masuda et al.            |
| 8,093,486 | B2   | 1/2012  | Behringer et al.     | 8,749,963    | B2   | 6/2014  | Staats et al.            |
| D659,139  | S    | 5/2012  | Gengler              | 8,749,970    | B2   | 6/2014  | Petersson                |
| 8,190,222 | B2   | 5/2012  | Cheng                | 2003/0041206 | A1   | 2/2003  | Dickie                   |
| 8,203,657 | B2   | 6/2012  | Vitito               | 2003/0137584 | A1   | 7/2003  | Norvell et al.           |
| 8,204,561 | B2   | 6/2012  | Mongan et al.        | 2004/0080899 | A1   | 4/2004  | Hill et al.              |
| D662,925  | S    | 7/2012  | Mayberry et al.      | 2004/0227372 | A1   | 11/2004 | Lavelle et al.           |
| 8,238,086 | B2   | 8/2012  | Ou                   | 2005/0185364 | A1   | 8/2005  | Bell et al.              |
| 8,245,842 | B2   | 8/2012  | Bau                  | 2008/0157574 | A1   | 7/2008  | LaRussa                  |
| 8,295,043 | B2   | 10/2012 | Tai                  | 2008/0225471 | A1   | 9/2008  | Takizawa                 |
| RE43,869  | E    | 12/2012 | Lewandowski et al.   | 2008/0252118 | A1 * | 10/2008 | Chang ..... B60R 11/0235 |
| 8,353,083 | B2 * | 1/2013  | Wu ..... G06F 1/1616 |              |      |         | 297/217.3                |
|           |      |         | 16/255               |              |      |         |                          |
| 8,369,082 | B2   | 2/2013  | Madonna et al.       | 2008/0270665 | A1   | 10/2008 | Senatori et al.          |
| 8,379,382 | B2   | 2/2013  | Marshall et al.      | 2010/0062816 | A1   | 3/2010  | Yu                       |
| 8,382,059 | B2   | 2/2013  | Le Gette et al.      | 2010/0072334 | A1   | 3/2010  | Le Gette et al.          |
| 8,395,894 | B2   | 3/2013  | Richardson et al.    | 2010/0078343 | A1   | 4/2010  | Hoellwarth et al.        |
| 8,439,191 | B1   | 5/2013  | Lu                   | 2010/0172081 | A1   | 7/2010  | Tian et al.              |
| 8,472,186 | B2   | 6/2013  | Probst et al.        | 2011/0222238 | A1   | 9/2011  | Staats et al.            |
| 8,488,832 | B2   | 7/2013  | Leung                | 2011/0240830 | A1   | 10/2011 | Alemozafar et al.        |
| 8,509,865 | B1   | 8/2013  | LaColla et al.       | 2012/0008269 | A1   | 1/2012  | Gengler                  |
| 8,531,833 | B2   | 9/2013  | Diebel et al.        | 2012/0071217 | A1   | 3/2012  | Park                     |
| 8,548,541 | B2   | 10/2013 | Rayner               | 2012/0097831 | A1   | 4/2012  | Olukotun et al.          |
| 8,573,394 | B2   | 11/2013 | Ahee et al.          | 2012/0104185 | A1   | 5/2012  | Carroll                  |
| D694,742  | S    | 12/2013 | Pan                  | 2012/0162891 | A1   | 6/2012  | Tranchina et al.         |
| 8,619,416 | B2   | 12/2013 | Lim                  | 2012/0175474 | A1   | 7/2012  | Barnard et al.           |
| 8,630,088 | B2   | 1/2014  | Collopy et al.       | 2012/0199501 | A1   | 8/2012  | Le Gette et al.          |
| 8,638,557 | B2   | 1/2014  | Tsai                 | 2012/0217257 | A1   | 8/2012  | Ting                     |
| 8,659,889 | B2   | 2/2014  | Dolci et al.         | 2013/0009032 | A1   | 1/2013  | Polletta et al.          |
| 8,665,045 | B2   | 3/2014  | Lauder et al.        | 2013/0026324 | A1   | 1/2013  | Fischer et al.           |
| 8,675,359 | B2   | 3/2014  | Chen                 | 2013/0043290 | A1   | 2/2013  | Prater et al.            |
| 8,702,055 | B2   | 4/2014  | Alemozafar et al.    | 2013/0119727 | A1   | 5/2013  | Lavelle et al.           |
| 8,706,176 | B1   | 4/2014  | Jia et al.           | 2013/0213838 | A1   | 8/2013  | Tsai et al.              |
| 8,708,142 | B2   | 4/2014  | Rayner               | 2013/0334072 | A1   | 12/2013 | Rayner                   |
| 8,714,347 | B2   | 5/2014  | Mongan et al.        |              |      |         |                          |
| 8,718,731 | B1   | 5/2014  | Tang                 |              |      |         |                          |

## OTHER PUBLICATIONS

Author Unknown, WOW-Keys Top View Photo.  
 Author Unknown, FiField Fabrications Website, Fifielfabrications.com, Sep. 12, 2014.

\* cited by examiner



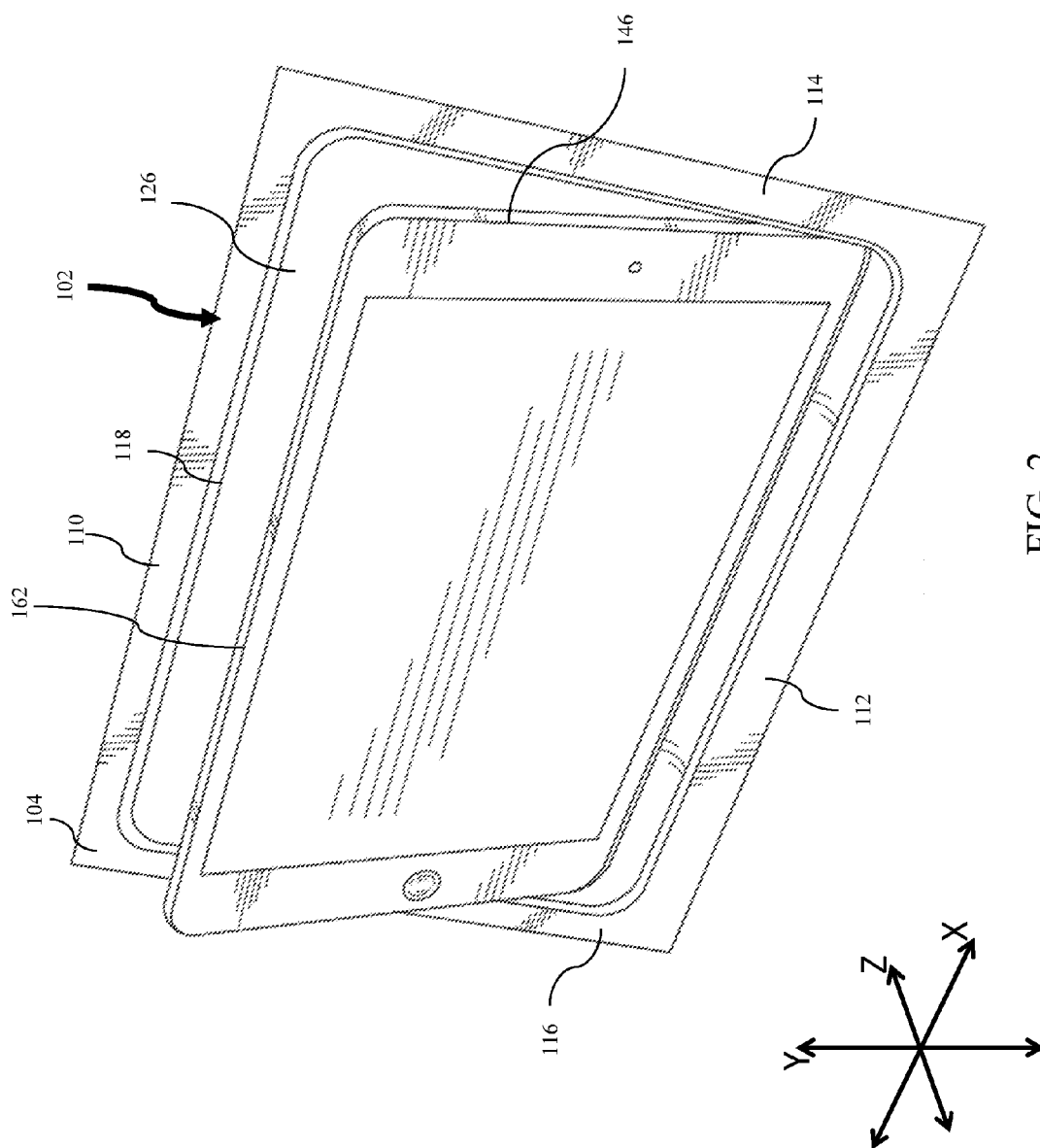


FIG. 2

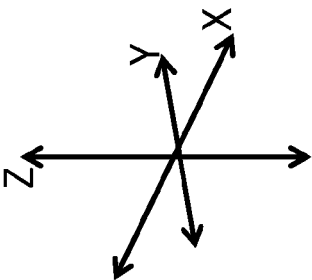
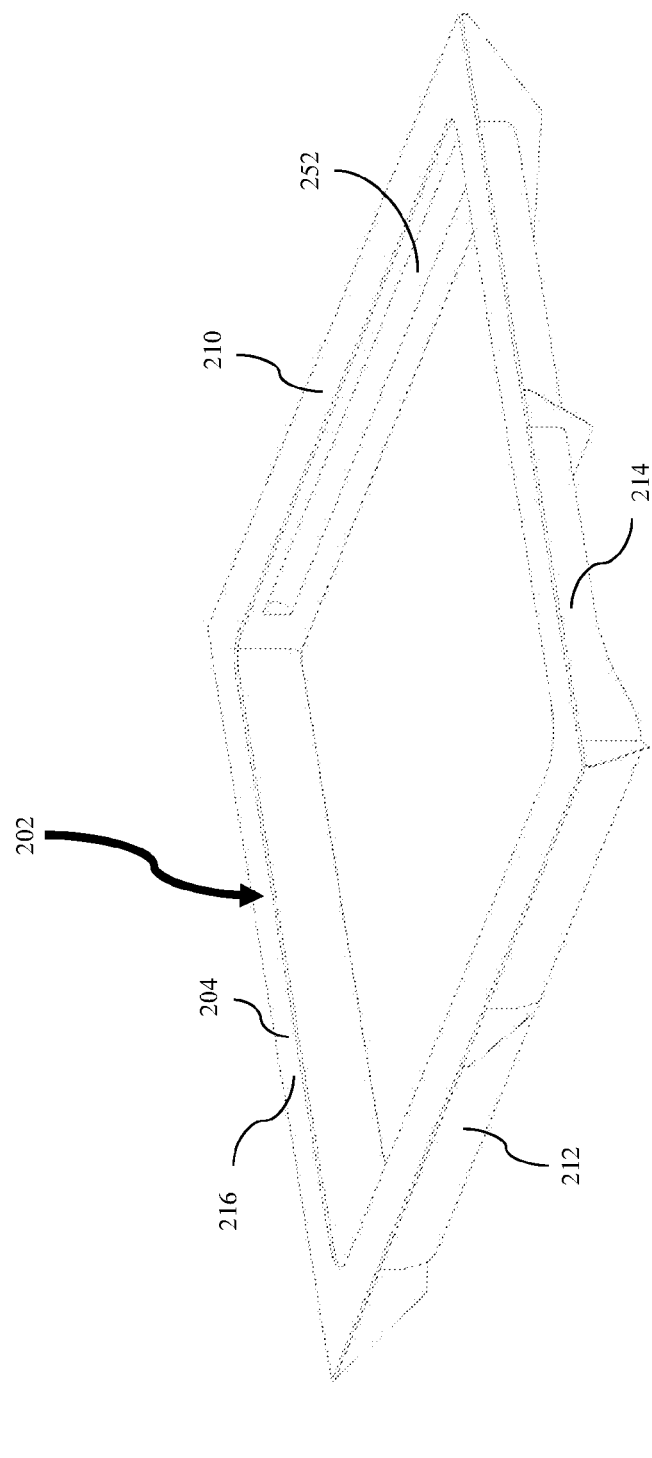


FIG. 3

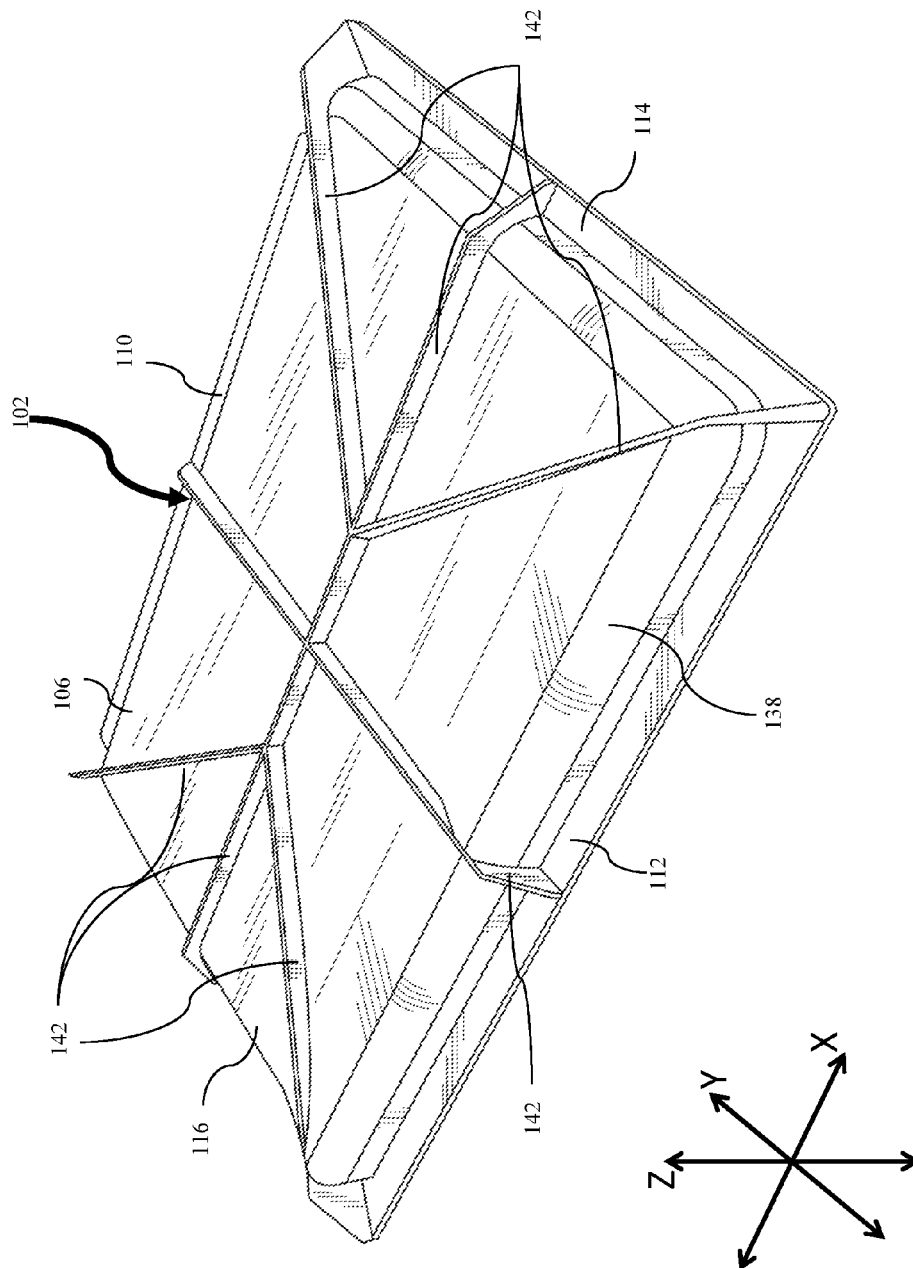


FIG. 4

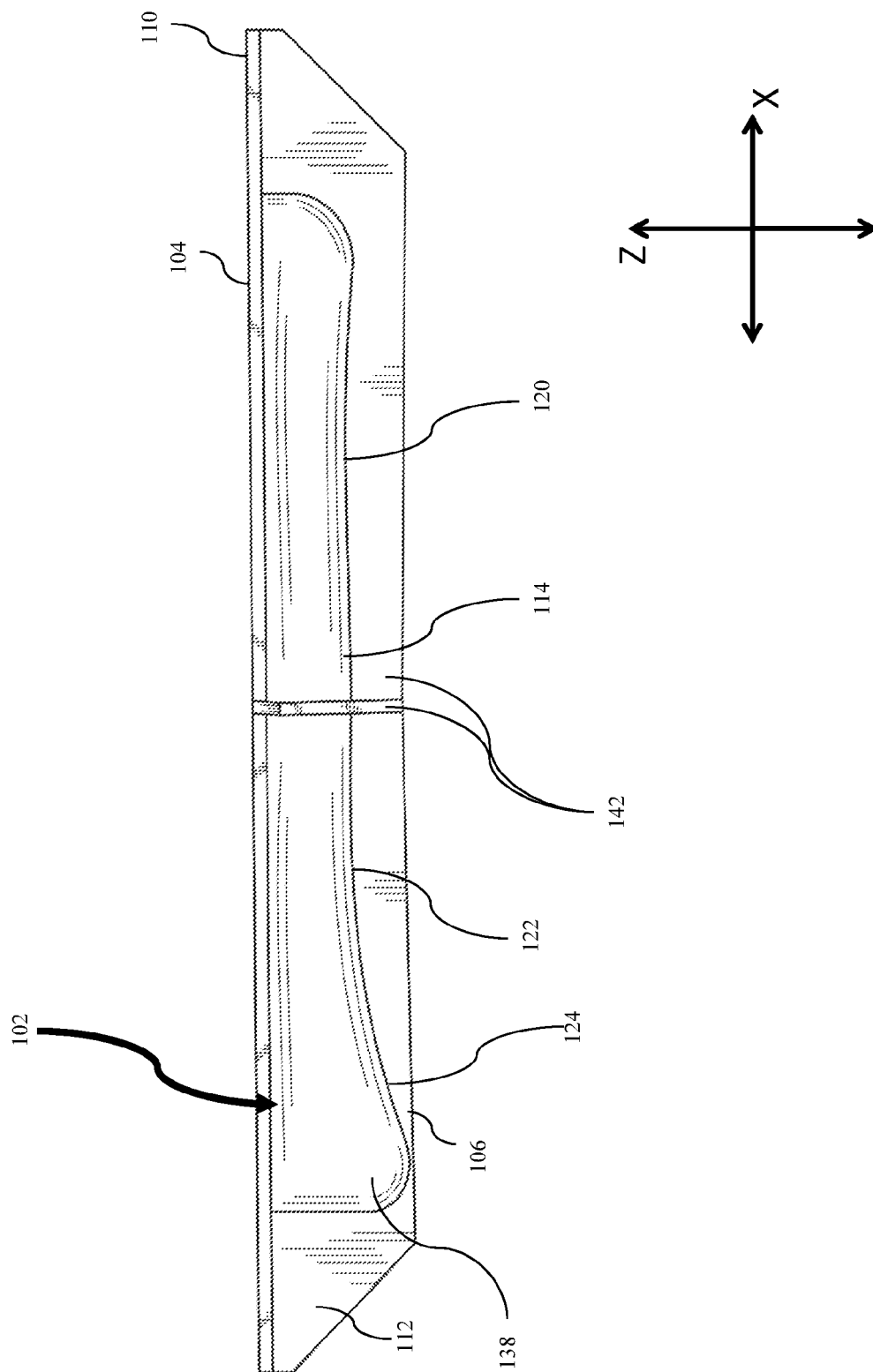


FIG. 5

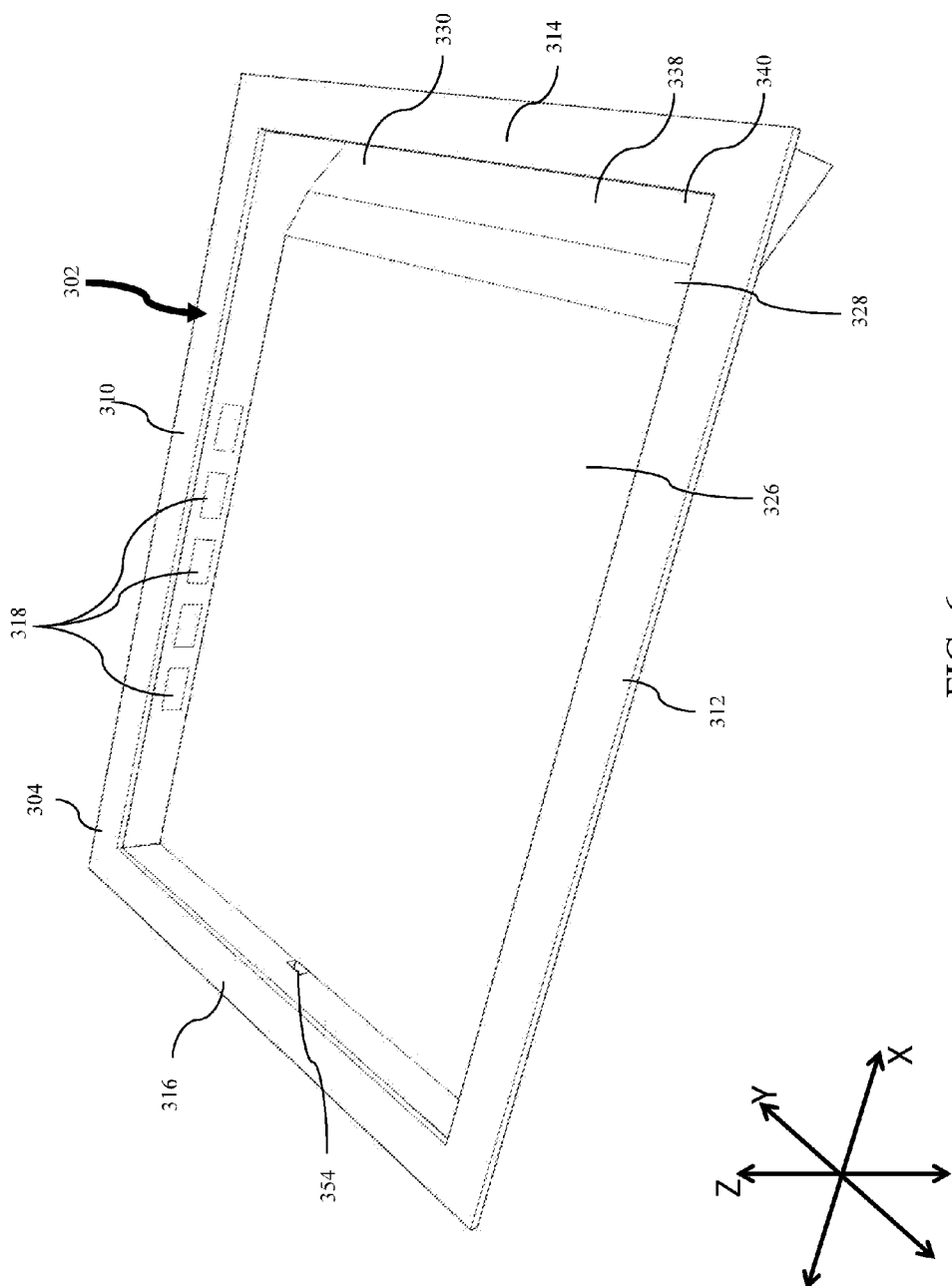


FIG. 6



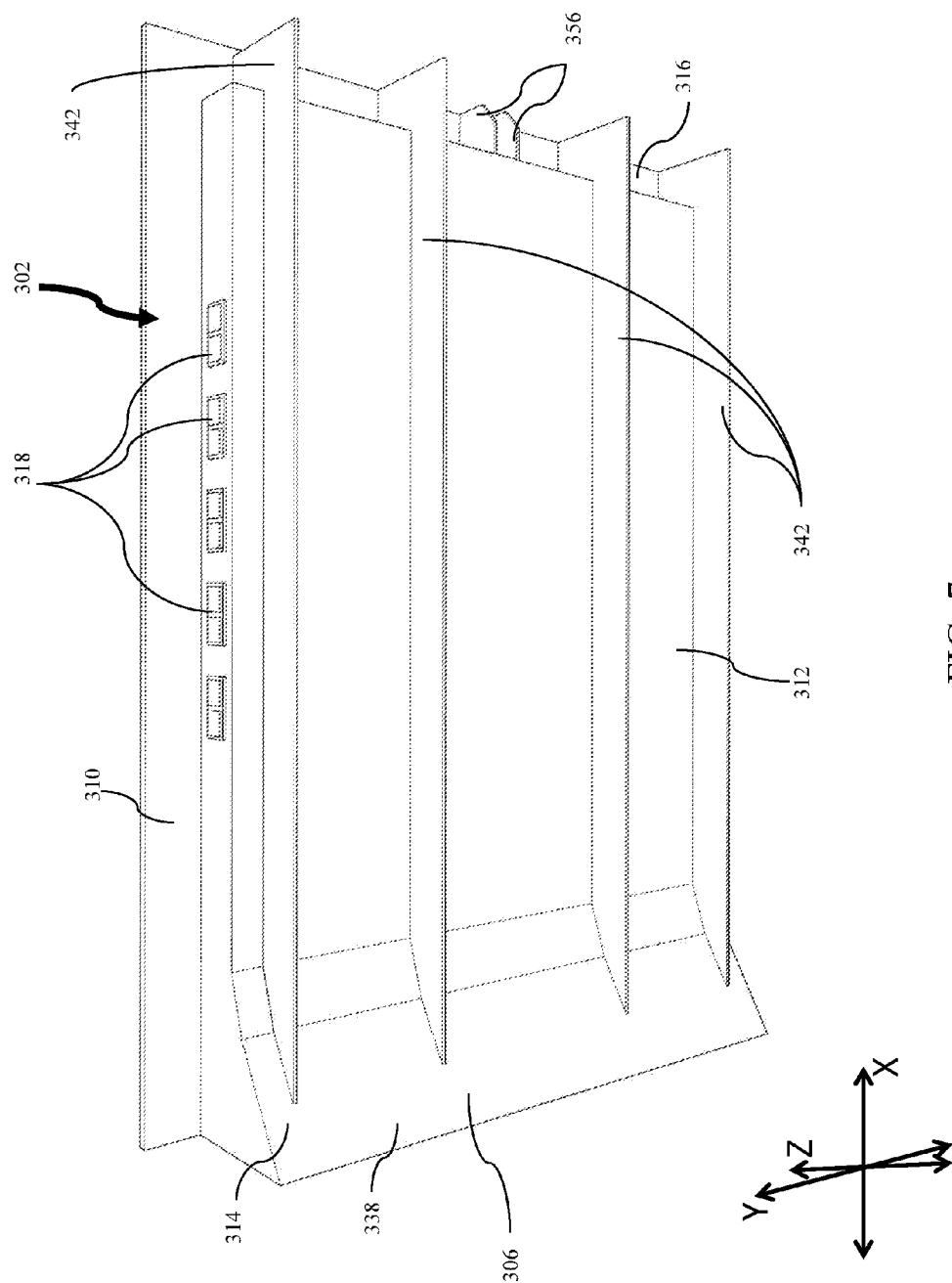


FIG. 7

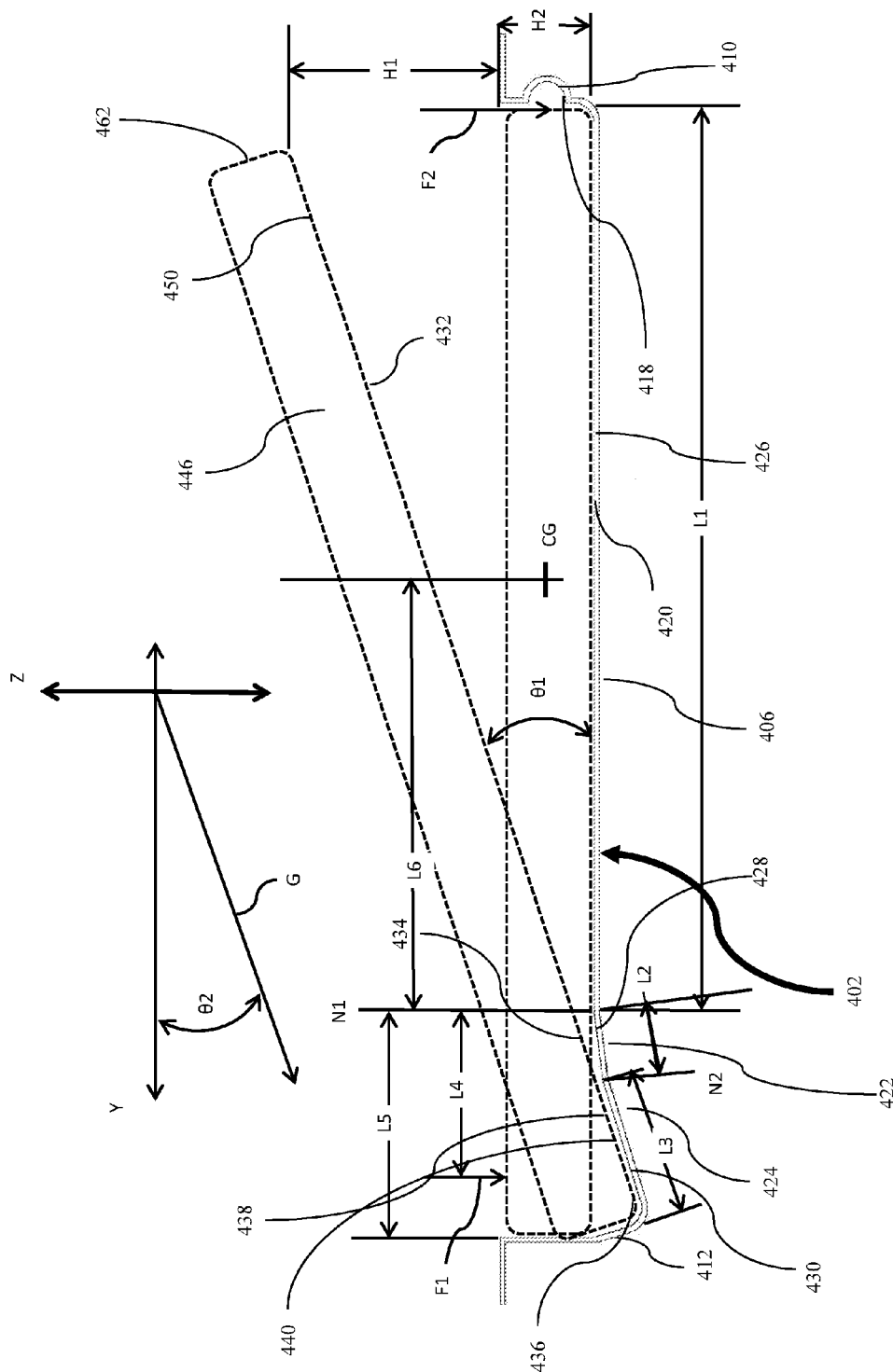


FIG. 8

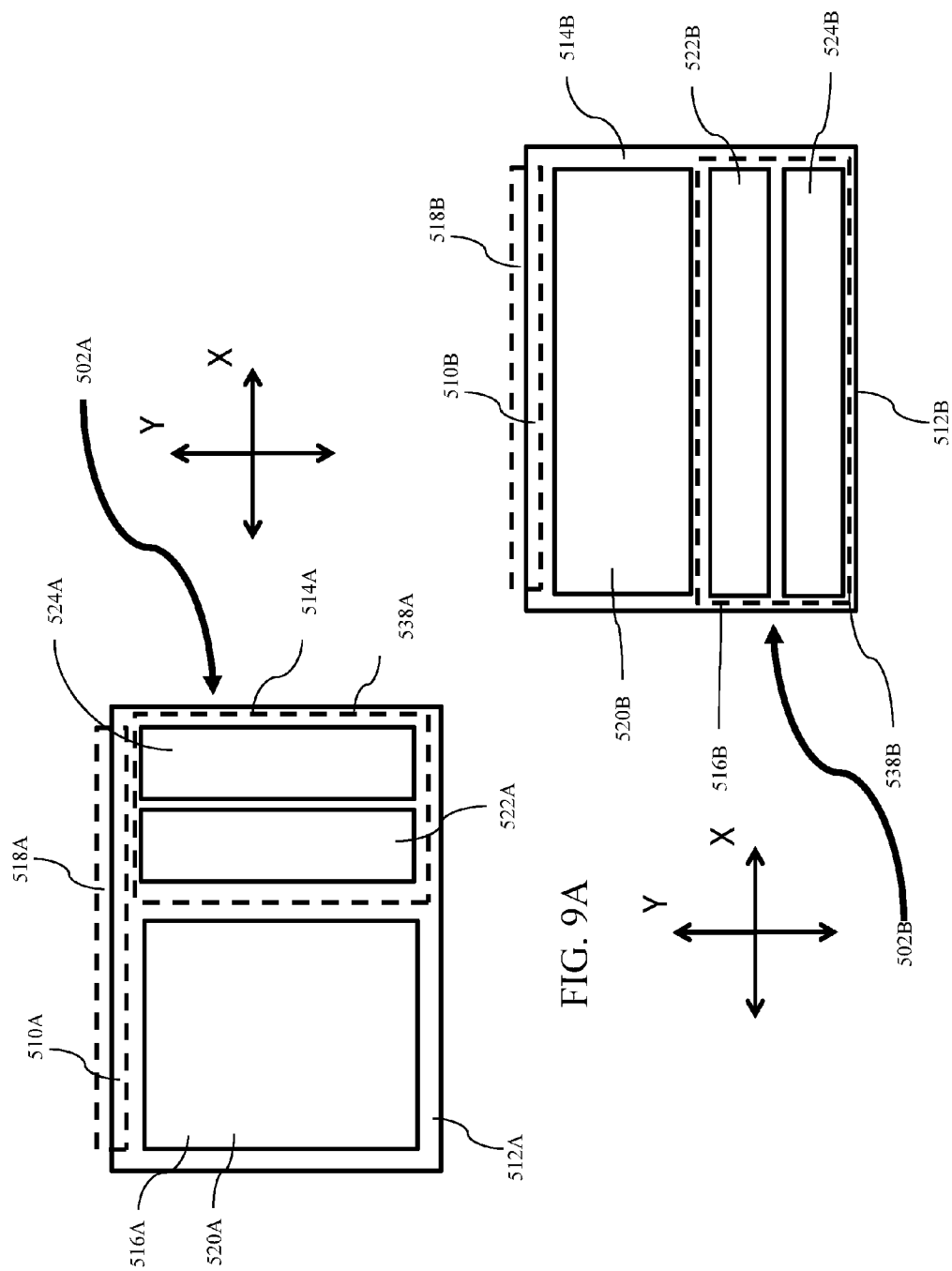


FIG. 9B

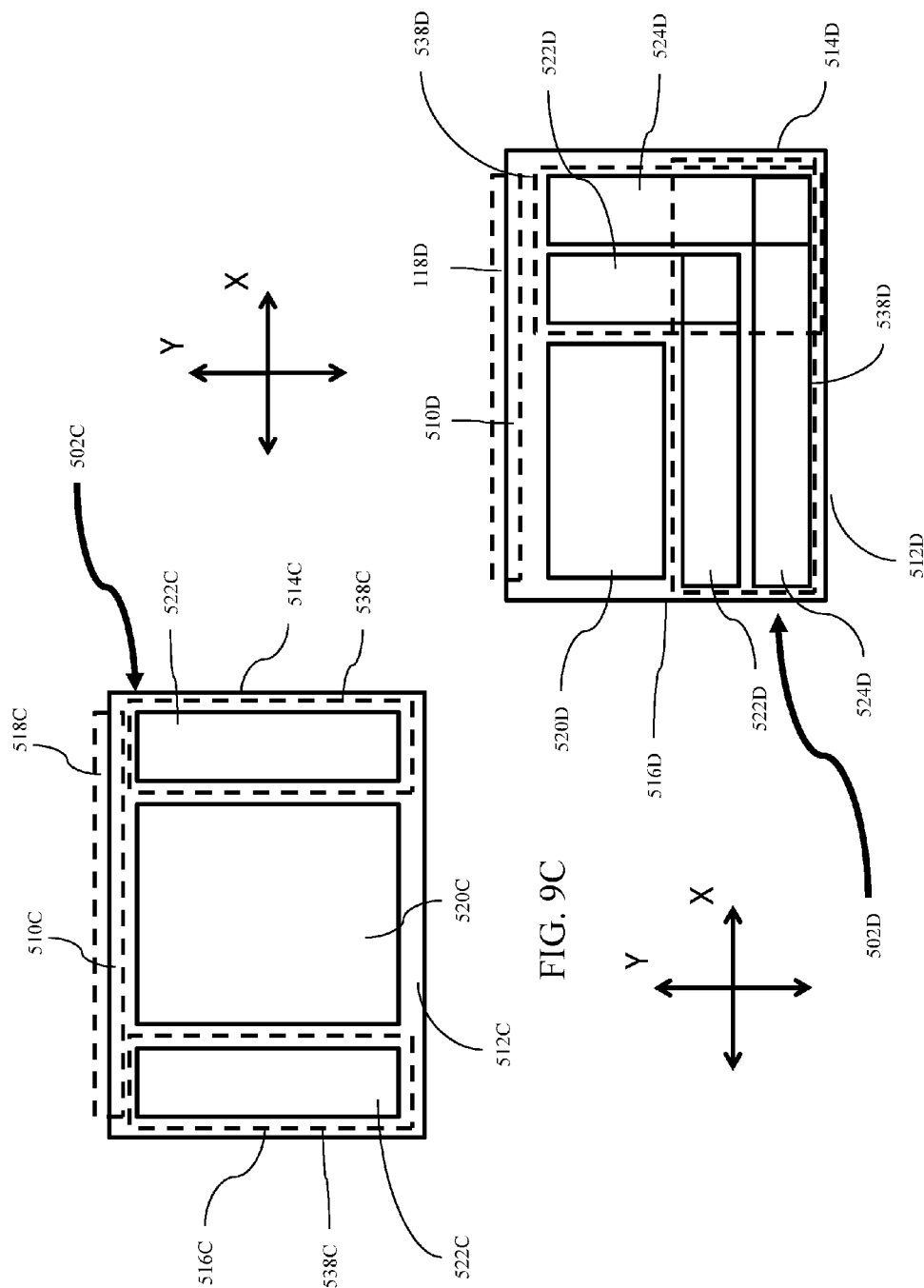


FIG. 9D

FIG. 9C

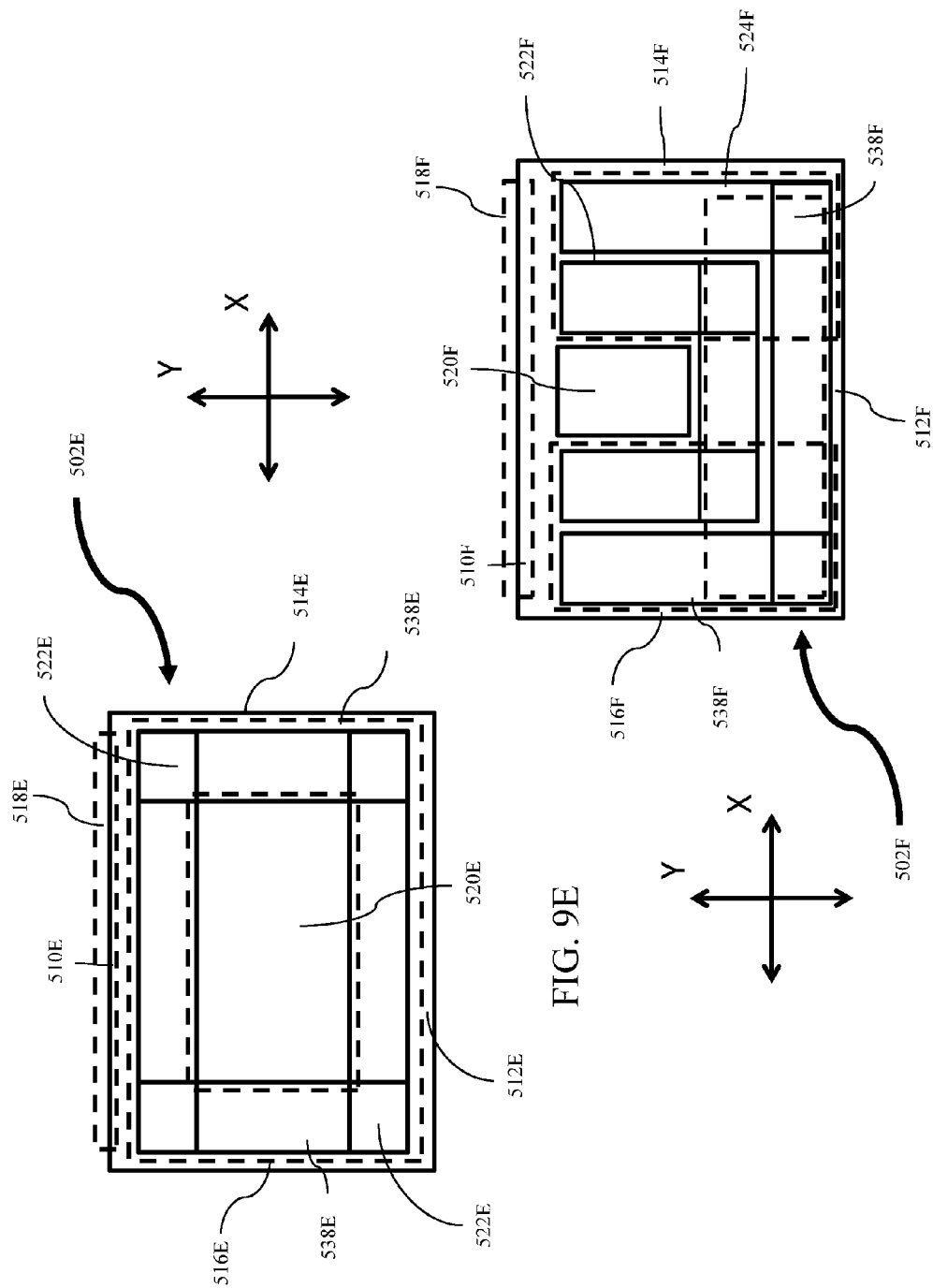
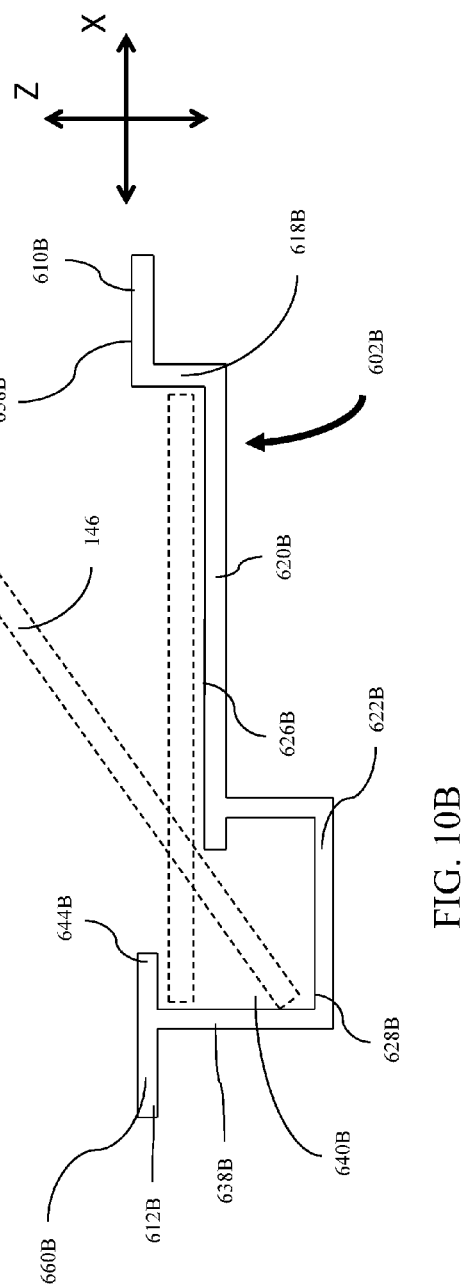
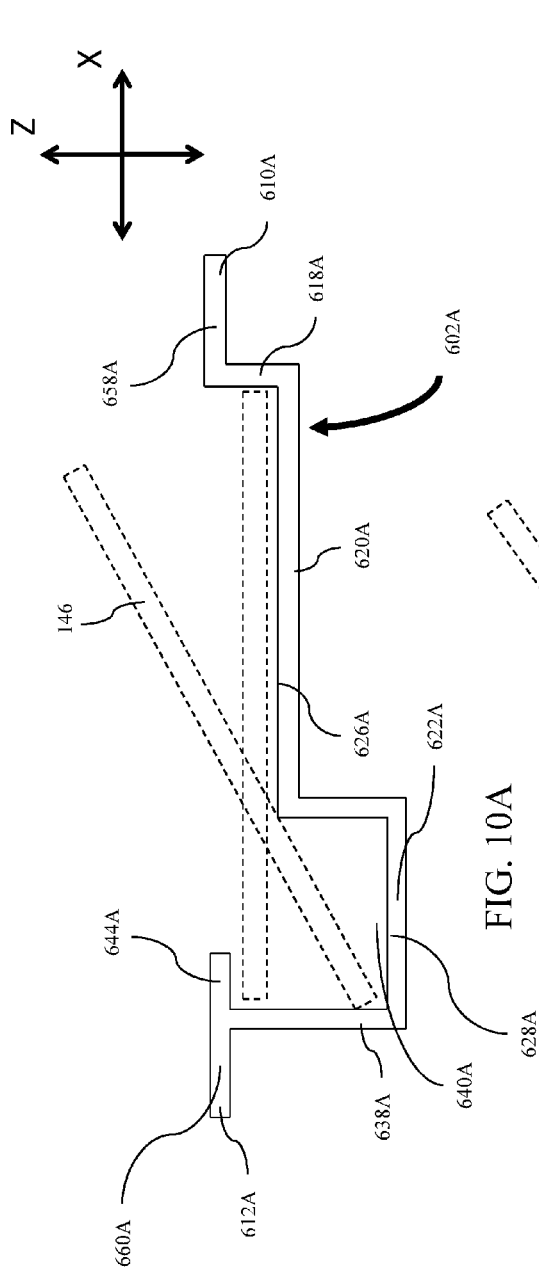
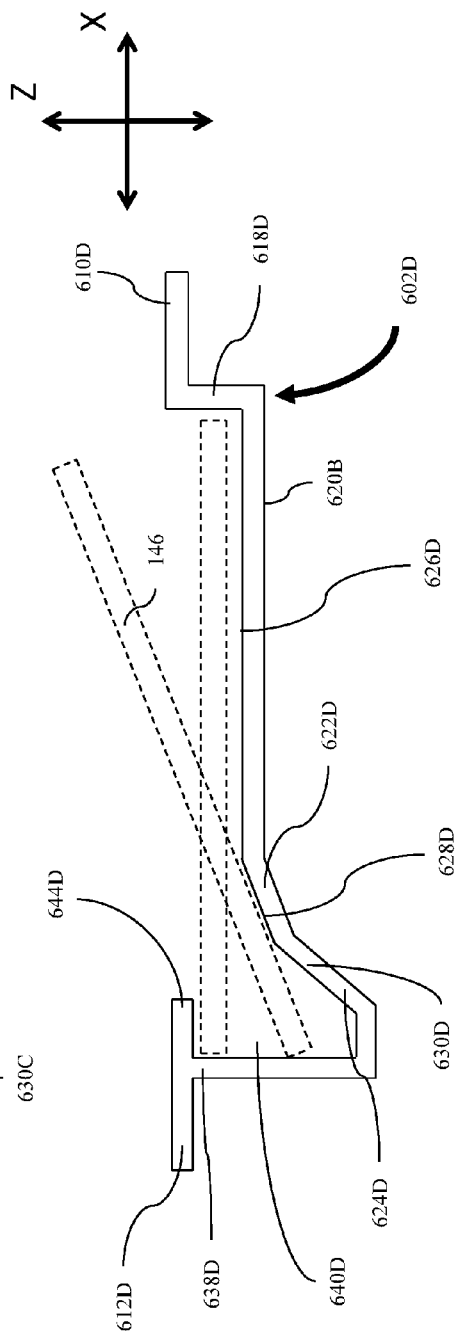
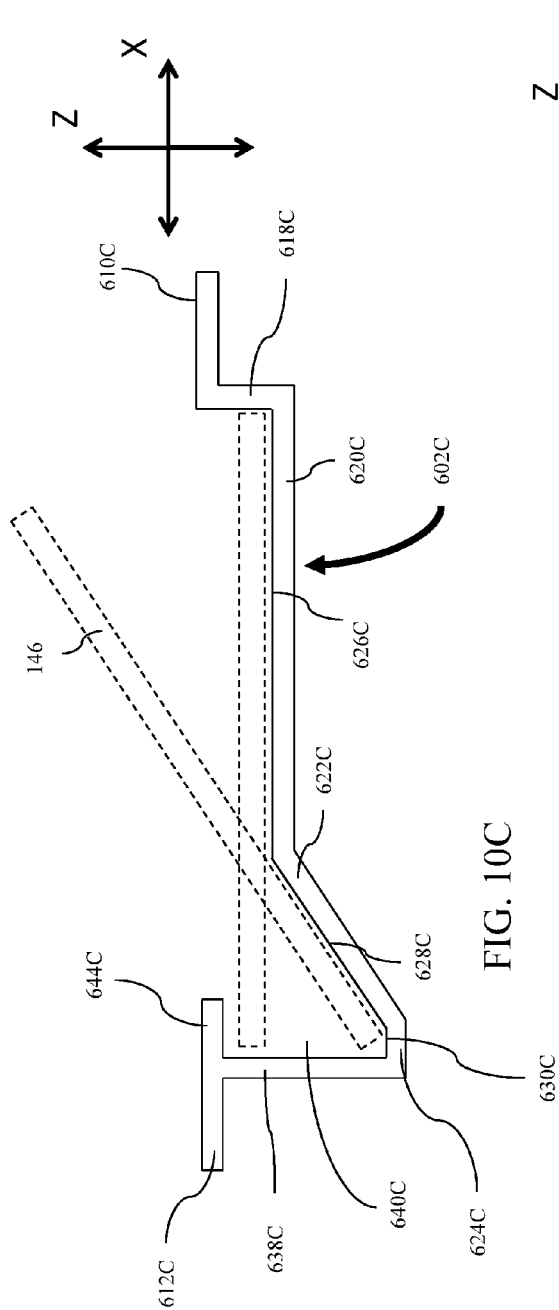


FIG. 9F

FIG. 9E





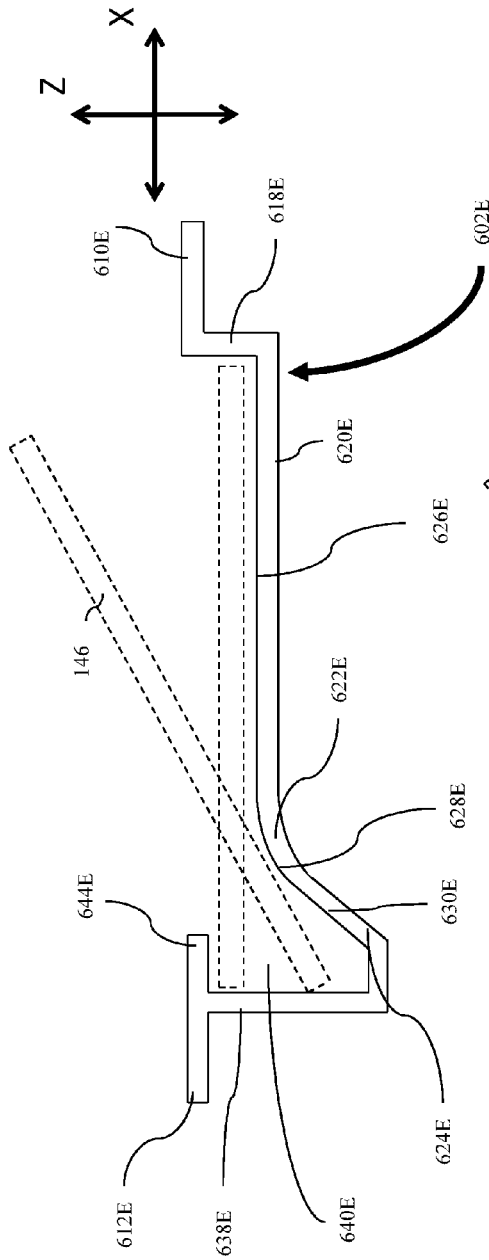


FIG. 10E

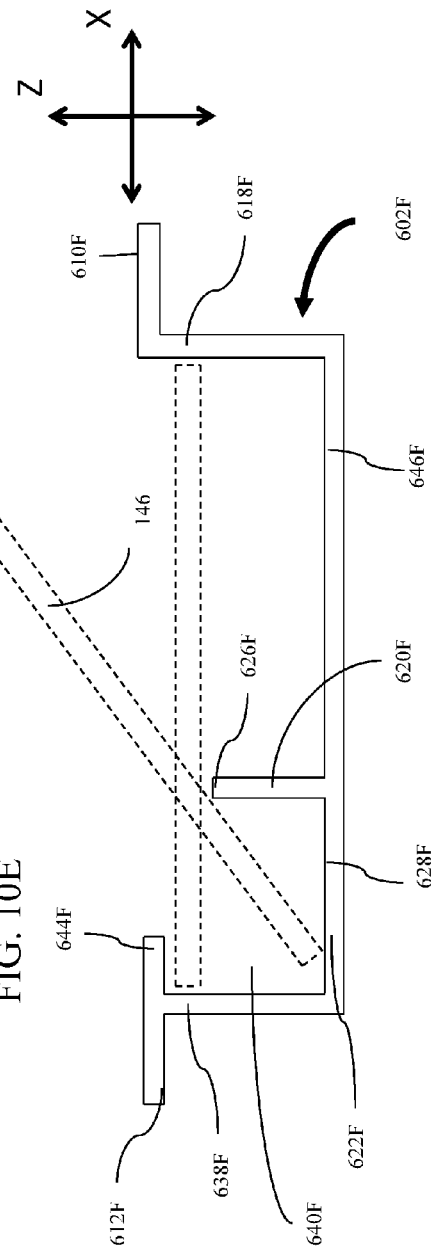


FIG. 10F



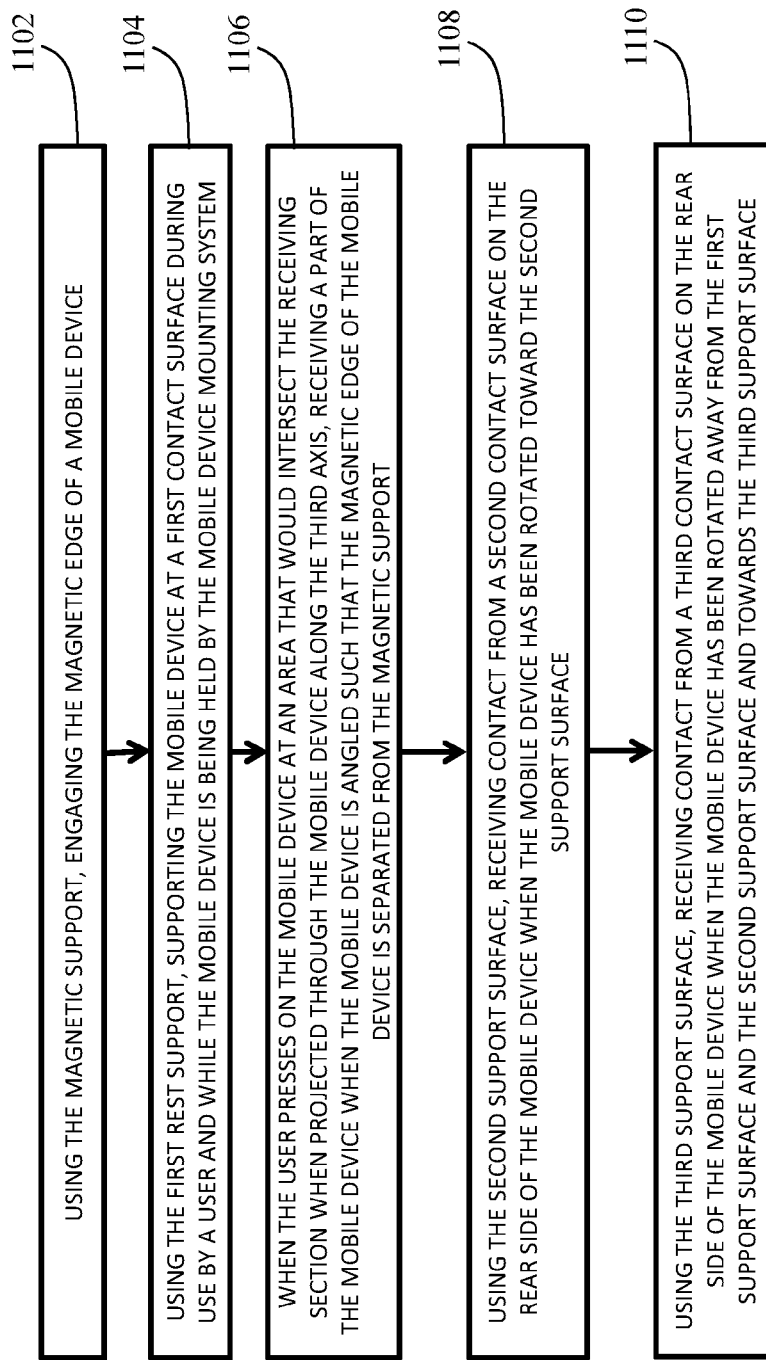


FIG. 11

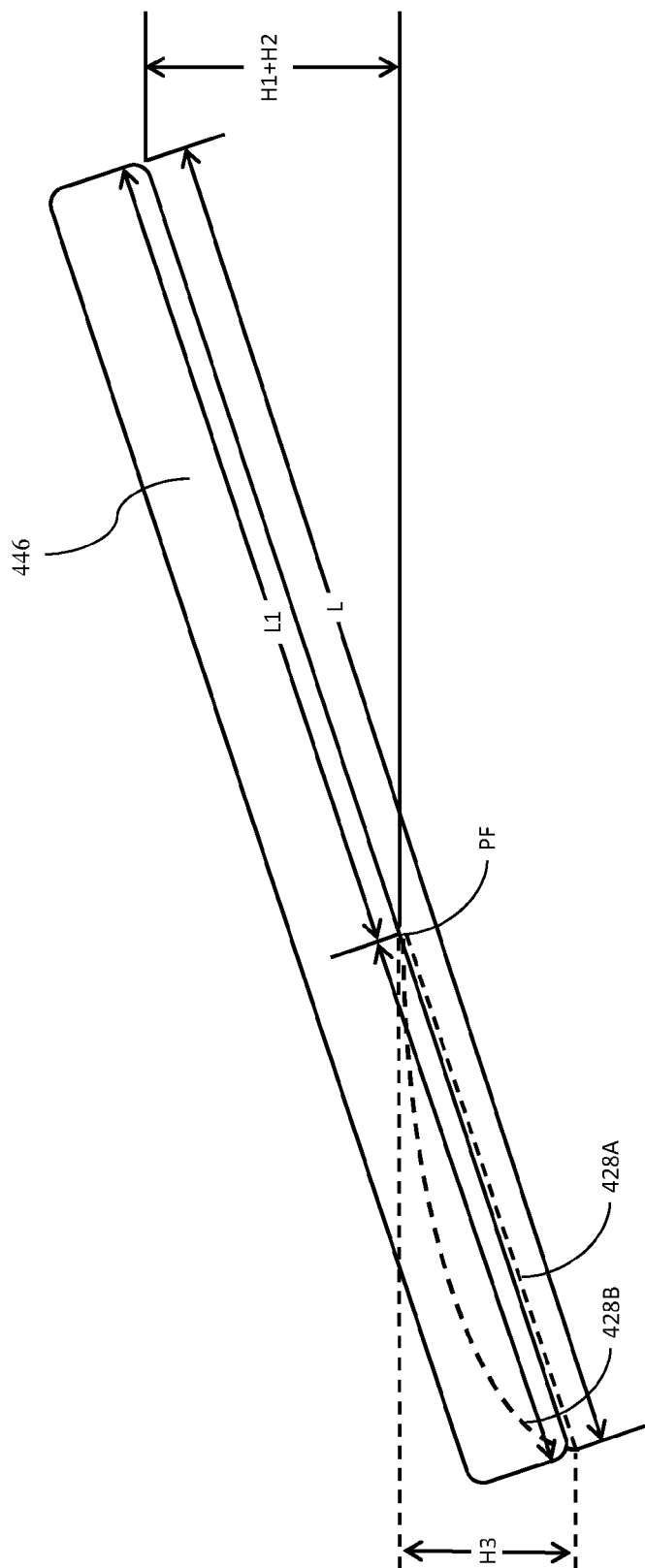


FIG. 12

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**MOBILE DEVICE MOUNTING SYSTEM AND METHOD****CROSS REFERENCE TO RELATED APPLICATION**

This application claims the benefit of U.S. Provisional Application Ser. No. 61/879,064, filed on Sep. 17, 2013, the entirety of which is incorporated herein by reference.

**BACKGROUND****1. Technical Field**

This invention relates to mounting systems, and more particularly to a mobile device mounting system and method.

**2. Description of the Related Art**

Conventional systems may require substantial time and effort for a user to mount a mobile device, such as in the dashboard of a vehicle, on a wall, or at another location. For example, a user may be required to use tools to install a cover plate over a mobile device to secure the mobile device in the dashboard. Other conventional systems may require multiple parts to be engaged and assembled together to hold the mobile device in place, which may be difficult for a user to understand and learn how to use. In addition, such conventional systems may involve multiple moving parts, each of which may add to an assembly and manufacturing cost, and which may also create an additional point of failure.

Accordingly, improvements may be made over such conventional systems.

**SUMMARY**

In an aspect, a mobile device mounting system configured to hold a mobile device, the device preferably having a magnetic edge. The mounting system has a receiving section having a recess for receiving the device. The recess is preferably shaped to correspond or substantially correspond to the size and shape of the mobile device so that the mobile device fits within the recess. The system is adapted for easily inserting, holding and easily removing the mobile device, preferably without any moving parts. The mobile device may be held in the recess of the receiving section preferably by magnets, by friction, or a combination of magnets and friction. The recess is constructed, as explained herein, such that the removal of the mobile device is by simply pressing on or near one edge of the device, eliminating the need for any moving parts, springs and/or other parts that tend to increase the cost of manufacture and assembly and/or tend to fail more easily.

For purposes of explanation, a three axis coordinate system is used to describe relative directions (e.g., a Cartesian coordinate system, or orthogonal X, Y, and Z axes). A first axis may represent an X axis, a second axis may represent a Y axis, and a third axis may represent a Z axis. In various embodiments, the first, second, and third axis may represent other axes.

In the system, there preferably is a magnetic support, a rest support, and the receiving section. The magnetic support extends along a first axis. The rest support is mechanically coupled to the magnetic support and extends away from the magnetic support along a second axis that is perpendicular to the first axis. The rest support has a first support surface that contacts a first contact surface on a rear side of the mobile device when the mobile device is moved downward along a third axis that is perpendicular to the first axis and the second axis to be held by the mobile device mounting system for viewing.

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The receiving section is mechanically coupled to the first rest support. The receiving section defines a recessed area relative to the first support surface along the third axis, the recessed area being configured to receive a part of the mobile device when the mobile device is angled such that the magnetic edge of the mobile device is separated from the magnetic support.

The receiving section may include a first rotation support that has a second support surface that contacts a second contact surface on the rear side of the mobile device when the mobile device has been rotated toward the second support surface. The second support surface may be curved such that a part of the second contact surface that is in contact with the second support surface changes as the mobile device is rotated around the first rotation support. The curve of the second support surface may decrease in radius with increasing distance away from the first support surface.

The receiving section may include a second rotation support that is mechanically coupled to the first rotation support. The second rotation support may have a third support surface that contacts a third contact surface on the rear side of the mobile device when the mobile device has been rotated away from the first support surface and the second support surface and towards the third support surface. The third support surface may extend away from the second support surface along the second axis while extending toward a back side of the mobile device mounting system along the third axis.

In another aspect, a method of manufacturing a mobile device mounting system configured to hold a mobile device having a magnetic edge includes forming a magnetic support that extends along a first axis, mechanically coupling a rest support to the magnetic support, and mechanically coupling a receiving section to the first rest support.

The rest support extends away from the magnetic support along a second axis that is perpendicular to the first axis. The rest support has a first support surface that contacts a first contact surface on a rear side of the mobile device when the mobile device is moved downward along a third axis that is perpendicular to the first axis and the second axis to be held by the mobile device mounting system for viewing, and the mobile device's magnetic edge is adjacent to and magnetically engaged with the magnetic support.

The receiving section defines a recessed area relative to the first support surface along the third axis. The recessed area is configured to receive a part of the mobile device when the mobile device is angled such that the magnetic edge of the mobile device is separated from the magnetic support.

In another aspect, a method of operation of a mobile device mounting system includes, using the magnetic support, engaging the magnetic edge of a mobile device. The method further includes, using the first rest support, supporting the mobile device at a first contact surface during use by a user and while the mobile device is being held by the mobile device mounting system. The method also includes, when the user presses on the mobile device at an area that would intersect the receiving section when projected through the mobile device along the third axis, receiving a part of the mobile device when the mobile device is angled such that the magnetic edge of the mobile device is separated from the magnetic support.

The receiving section may include a first rotation support that has a second support surface, and the method may further include, using the second support surface, receiving contact from a second contact surface on the rear side of the mobile device when the mobile device has been rotated toward the second support surface.

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The second support surface may be curved such that a part of the second contact surface that is in contact with the second support surface changes as the mobile device is rotated around the first rotation support. The curve of the second support surface may decrease in radius with increasing distance away from the first support surface.

The receiving section may include a second rotation support that is mechanically coupled to the first rotation support, and the second rotation support may have a third support surface. The method may further include, using the third support surface, receiving contact from a third contact surface on the rear side of the mobile device when the mobile device has been rotated away from the first support surface and the second support surface and towards the third support surface.

The third support surface may extend away from the second support surface along the second axis while extending toward a back side of the mobile device mounting system along the third axis.

In a preferred embodiment, the mobile device mounting system enables secure reception and quick ejection, both preferably without any moving parts in the mounting system.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front perspective view of a mobile device held by a mobile device mounting system, according to a first embodiment;

FIG. 2 is a front perspective view of the mobile device being angled out of the mobile device mounting system, according to the first embodiment;

FIG. 3 is a perspective view of a mobile device mounting system, according to a variation of the first embodiment;

FIG. 4 is a rear perspective view of the mobile device mounting system, according to the first embodiment;

FIG. 5 is a side view of the mobile device mounting system, according to the first embodiment;

FIGS. 6 and 7 are perspective views of the mobile device mounting system, according to a second embodiment;

FIG. 8 is a schematic diagram of operation of a mobile device mounting system, according to various embodiments;

FIGS. 9A-9F illustrate various arrangements of mobile device mounting systems, according to various embodiments;

FIGS. 10A-10F illustrate cross-sectional views of mobile device mounting systems, according to various embodiments;

FIG. 11 is a flowchart of operations of a mobile device mounting system, according to an embodiment; and

FIG. 12 is a schematic diagram from the side of the mobile device and recess of the device mounting system for further explaining operation of the mobile device mounting system.

#### DESCRIPTION OF EXEMPLARY EMBODIMENTS

Exemplary embodiments of the invention are described in detail below. Note that the following exemplary embodiments do not in any way limit the scope of the invention. Note also that all of the elements described in connection with the following exemplary embodiments should not necessarily be taken as essential elements of the invention.

##### I. Overview

In various embodiments, the device includes a body configured to magnetically hold and/or suspend a mobile device. The mobile device may be a tablet computer such as an

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iPad®, a smartphone, a watch, or another mobile computing device with a screen and a processor.

The user can insert a first edge of the mobile device into a receiving section, which may be recessed. The user can then rotate the mobile device around its first edge to become flush with the body. A second edge of the mobile device that is opposite the first edge may then be brought into proximity with the second section of the body, which is opposite the first section. Once the second edge is close enough to the second section, magnets disposed within the mobile device and the body may become magnetically engaged, holding the mobile device flat within the body.

When the user wishes to extract the mobile device from the body, the user may be able to press one of the edges of the mobile device into a receiving section formed with a recessed area, causing the mobile device to tilt out of the body at a distal side and/or corner. The mobile device may be rotated such that the device may be grasped with the fingers of the user's hands.

By supporting the mobile device using a combination of magnetic attraction and physical support, and by permitting the user to eject the mobile device while pressing the mobile device **146**, the system may provide advantages over conventional systems.

In some embodiments, the device may include a transition area that changes the amount of force needed to rotate the mobile device depending on the relative angle between the mobile device and the body.

##### A. First Embodiment and Variations

FIGS. 1, 2, 3, 4, and 5 illustrate features of a mobile device mounting system **102**, according to a first embodiment and a variation of the first embodiment. As shown, a Z-axis represents a viewing axis (e.g., a third axis) while the X-axis and the Y-axis (e.g., a first axis and a second axis) represent axes corresponding to a length and width, respectively, of mobile device mounting system **102**.

FIGS. 1 and 2 illustrate a mobile device **146** being held within and being tilted (or rotated) out of the mobile device mounting system **102**. In the embodiment of FIG. 1, the mobile device **146** can be held flush within the body of the mobile device mounting system **102**, which includes a first end **110**, a second **112**, a third end **114**, and a fourth end **116**. Each end includes a flange that extends outward from the center of the mobile device mounting system **102**. The flanges may be secured to a fixed object such as a car dash, the back of a seat or headrest, a wall, a refrigerator door, or another object where the mobile device mounting system **102** may be secured. The front side **104** of the mobile device mounting system **102** is oriented towards a user who wishes to view the mobile device **146**.

As shown in FIG. 2, when the mobile device **146** has been angled outward from the mobile device mounting system **102**, the mobile device **146** may be angled such that a magnetic edge **162** is separated from a magnetic support **118**. When sufficiently separated, a user may easily grasp the edge of the mobile device **146** for removal. When the procedure is reversed, a user may insert the mobile device **146** into the mobile device mounting system **102** at the same or similar angles.

FIG. 3 includes a front perspective view of the mobile device mounting system **202**, which is a variation of the mobile device mounting system **102**. As shown, the mobile device mounting system **202** includes a front side **204**, a first end **210**, a second end **212**, a third end **214**, a fourth end **216**, and a magnetic support cavity **252**.

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The magnetic support cavity **252** is formed within the first end **210**. As shown, the magnetic support cavity **252** opens into a main cavity formed within the body of the mobile device mounting system **202** between the first end **210**, the second end **212**, the third end **214**, and the fourth end **216**. In other variations, permanent magnets may be installed in the magnetic support cavity **252**, which may be covered or sealed during manufacture. In lieu of the magnet(s) and magnetic support or in addition thereto, the mounting system shown in the drawings has the recess sized in the X and Y directions to friction fit the electronic device or tablet device therein.

When the mobile device mounting system **202** is mounted in a car dash or a wall or other object, the magnetic support cavity **252** may be disposed at an upper location, lower location, or at a lateral side of a user's perspective. As shown, the first end **210** is longer than the third end **214** and the fourth end **216**. The mobile device may also be mounted on a rod or the like.

FIG. **4** includes a rear perspective view of the mobile device mounting system **102**, illustrating the back side **106**. Also shown are multiple support flanges **142**. As shown, a support flange **142** extends between the first end **110** and the second end **112**. An additional support flange **142** extends between the third end **114** and the fourth end **116**. Support flanges **142** also extend diagonally from corners of the mobile device mounting system **102** to a central support flange **142** that extends between the third end **114** and the fourth end **116**. The diagonally extending support flanges **142** intersect with the central support flange **142** before the support flange **142** extending between the first end **110** and the second end **112**. The support flanges **142** extend within the plane formed by the X-axis and the Y-axis.

The support flanges **142** may provide benefits such as reduced weight and/or material cost while increasing product rigidity. For example, the support flanges **142** as configured may provide increased stiffness that reduces bending and flexing around the X and Y axes as well as bending around other axes within the XY plane defined by the X axis and the Y axis.

As shown in FIG. **5**, which is a side view of the first embodiment, the rest support **120**, the first rotation support **122**, and the second rotation support **124** may have an exterior surface that form parts of the back side **106** of the mobile device mounting system **102**.

The front side **104** may include surfaces from each of the first end **110**, the second end **112**, the third end **114**, and the fourth end **116** (not shown). The front side **104** as shown is the front side of a frame that may be mounted in a car dash panel, a wall, or other object.

Also as shown in FIG. **5**, the receiving section **138** is curved to expand along the Z-axis as distance along the X-axis from the first end **110** becomes greater. The expansion provides additional room and support for an inner curved surface that defines a recessed area.

## B. Second Embodiment and Variations

FIGS. **6** and **7** illustrate features of a mobile device mounting system **102**, according to a second embodiment. As shown in FIG. **6**, the receiving section **338** is disposed at a side that is adjacent to the first end **310** that includes the magnetic support **318**. In this embodiment and its variations, the user may insert the mobile device (e.g. FIG. **1**, mobile device **146**) into a side adjacent to the magnetic support **318** rather than an opposite end. The second embodiment and its variations may be mounted with the magnetic support **318** at a top, bottom, or lateral edge.

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When the mobile device mounting system **302** is mounted in a car dash and positioned with the magnetic support(s) **318** at a top edge, this may allow the user to more quickly and/or easily insert the mobile device **146** into the mobile device mounting system **302** for users who typically hold a mobile device from a lateral side.

The system of the second embodiment and its variations may allow greater magnetic attraction between the magnetic support **318** and a magnetic edge of a mobile device **146** over a wider range of angles. For example, while the distal portion of a mobile device's **146** magnetic edge **162** relative to the receiving section **338** may be too far from a magnetic support **318** to experience significant magnet attraction, the proximal portion of a mobile device's magnetic edge **162** may still be close enough to a magnetic support **318** to experience magnetic attraction.

As shown, the magnetic support **318** may be composed of a series of discrete magnets. In other embodiments, the magnetic support **318** may be formed from a single permanent magnet, or from one or more other types of magnets (e.g., electromagnets). The magnetic support **318** may be disposed at a top, bottom, or lateral side of the frame.

FIGS. **6** and **7** also include a port **354** and port flanges **356**. In the illustrated embodiment, the port **354** and the port flanges **356** are disposed in the fourth end **316**. The port **354** is an opening formed in a wall that extends in the YZ plane, which is perpendicular to the X axis. The port **354** is disposed at a center of the wall along the Y axis to permit a user to connect a cable to the mobile device **146**, such as for data transmission or power supply to the mobile device **146**.

The port flanges **356** extend along the X axis away from the third end **314** adjacent to the port **354**. The port flanges **356** are parallel to each other and aligned with the XZ plane, which is perpendicular to the Y axis. The port flanges **356** provide support for a plug and/or cable.

## C. Angles and Measurements

FIG. **8** illustrates some angles and measurements associated with various embodiments. As shown in FIG. **8**, various embodiments of the mobile device mounting system **402** may hold a mobile device **446** at a lowered position with a magnetic edge **462** adjacent to a magnetic support **418**, and at an elevated position with the magnetic edge **462** separated from the magnetic support **418**. In operations involving the second embodiment and its variations, the mobile device mounting system **402** would also permit holding the mobile device **446** at elevated and lowered positions, but with different arrangements of the magnetic edge **462** and the magnetic support **418**. When the mobile device mounting system **402** is mounted in an angled car dash panel, gravity (G) may be oriented at an angle  $\theta 2$  relative to the Y axis.

At the lowered position, the first contact surface **432** of the mobile device **446** is in contact with the first support surface **426** of the rest support **420**. The magnetic support **418** is adjacent to the magnetic support **418**, and parts of the mobile device **446** are not in contact with the first rotation support **422** and the second rotation support **424**.

When the user wishes to remove the mobile device **446** from the mobile device mounting system **402**, the user may press on a front side (e.g., a screen side) of the mobile device **446** that is visible to the user. The user's pressing location may overlap with the first rotation support **422** or the second rotation support **424** when projected along the Z axis. In other embodiments, the pressing location may be at a location that is farther from the first end **410** than the first rotation support **422** or the second rotation support **424**.

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By pressing the surface of the mobile device 446, the user may cause the mobile device 446 to act as a lever that is rotated on a fulcrum. In various embodiments, one or more of the rest support 420, the first rotation support 422, and the second rotation support 424 may have curved surfaces that facilitate rotation of the mobile device 446.

The initial fulcrum (F1) may be located at a bordering edge between the first rotation support 422 and the rest support 420. As illustrated in FIG. 8, the distance from the fulcrum N1 to the end of the mobile device 446 having a magnetic edge 462 is L1 as measured along the Y axis. The length of the first rotation support 422 is L2, and the length of the third support surface 430 is L3. The distance from the distal edge of the mobile device 446 from the magnetic edge 462 to the fulcrum N1 is L5. The distance along the Y axis between the force F1 applied by a user and the fulcrum N1 is L4. The distance along the Y axis between the fulcrum N1 and the center of gravity (CG) of the mobile device 446 is L6.

The leverage that the user must apply to begin causing the mobile device 446 to be angled may need to be greater than the opposing leverage of the weight of the mobile device 446 and the opposing pull of the magnetic support 418. In the embodiment of FIG. 8, the magnetic support 418 is disposed at an opposite edge of the mobile device 446 relative to the fulcrum. In other embodiments, the magnetic support 418 may be disposed at a side of the mobile device mounting system 402 that is perpendicular to and adjacent to the fulcrum N1. The mass of the mobile device 446 may be M (e.g., kilograms mass). The acceleration due to gravity may be represented as G (e.g.,  $9.81 \text{ m/s}^2$ ).

The leverage applied by the user may be represented as  $F1 \cdot L4$ . The opposing leverage that the user's leverage should exceed may be represented as:  $M \cdot G \cdot \sin(\theta_2 - \theta_1) \cdot L_6 + F2 \cdot L1$ . Additional forces such as friction may also increase the amount of force that the user should exert to angle the mobile device 446 out of the mobile device mounting system 402 up to the elevated position.

As the angle  $\theta_1$  increases, the location of the fulcrum may remain fixed or may be changed. For example, the second contact surface 434 and/or the third support surface 430 may be flat or curved.

As the user applies force F1, the mobile device 446 may be rotated around the fulcrum location F1 away from the first support surface 426 and towards the second contact surface 434. For embodiments in which the second support surface 426 is flat, the mobile device 446 may continue to be rotated around the fulcrum F1 until the mobile device 446 is parallel to the second contact surface 434. For embodiments that include a second rotation support 424 with a third support surface 430, the user may continue to apply force F1 such that the mobile device 446 continues to rotate. Further rotation may be around the fulcrum location N2. For rotation around N2, the leverage applied by the user may be represented as  $F1 \cdot (L4 - L2)$ , and the opposing leverage from the weight of the mobile device 446 and/or the magnetic support 418 may be represented as  $M \cdot G \cdot \sin \theta_2 \cdot (L_6 + L_2) + F2 \cdot (L1 + L_2)$ .

For embodiments in which the second support surface 428 and/or the third support surface 430 are curved, the location of the fulcrum may vary as the angle  $\theta_1$  changes. As the lever arm is shortened and  $\theta_1$  increases, the user's applied torque for the same amount of force will decrease. At the same time, however, depending on the angle at which the mobile device mounting system 402 is mounted and the angle  $\theta_1$  to which the mobile device 446 is rotated, the weight of the mobile device 446 may oppose or accelerate rotation of the mobile device 446 away from the mobile device mounting system 402. In addition, magnetic forces between the magnetic sup-

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port 418 and the magnetic edge 462 may decrease rapidly with increasing distance along the Z axis. The change in position along the Z axis may be represented as  $H1 + H2$ .

The recessed area 440 of the receiving section 438 may be defined in whole or in part by the second support surface 428 and the third support surface 430. The recessed area 440 may be configured to be sufficiently deep and/or angled relative to the first support surface 426 to cause the mobile device 446 to have a maximum angle such that a distance H1 is reached between an innermost side of the mobile device 446 and a front side of the mobile device mounting system 402. The distance H1 preferably is sufficient for a user to insert one or more fingers between the mobile device 446 and the mobile device mounting system 402. For example, in a preferred embodiment, H1 may be greater than 1 centimeter. In other embodiments, H1 may be 1 millimeter or more. Such smaller gaps may still permit removal of the mobile device 446 from the mobile device mounting system 402.

In any event, the height above the side wall of the recess that the bottom of the mobile device must reach should preferably exceed the height of the side wall (H2) by a predetermined amount (PA) sufficient for the user to readily pry under or grip the exposed edge of the mobile device. Therefore, with reference to FIG. 12, the location of the pivot axis or fulcrum relative to the length (L) of the device along an axis normal to the pivot axis and the unrestricted depth to which the device may be pivoted about point PF must be such that:  $H1 + H2 = L1 \times (H3/L5)$ , where H3 represents the minimum unrestricted depth to which the device must be able to rotate downward,  $L5 \text{ plus } L1 = L$ ,  $H1 \geq PA$ . H2 is known (preferably equal to or close to the thickness H of the mobile device), and then H1 is known, leaving the selection of the pivot point to the designer, which then determines L1 and L5 since L is known, and so H3 may be determined once the pivot point is determined. Alternatively, the designer could select the depth H3 and then L1 or L5 may be determined. The second support surface 428A represents an angled surface. Alternatively, there may be multiple support surfaces as mentioned above, so a curved surface could form the second support surface 428B. In that case, the pivot point of the device continually moves.

#### D. Layout Variations

FIGS. 9A-9F illustrate possible layouts according to various embodiments. Some preferred embodiments include one or more first rotation supports that are recessed and/or angled relative to a rest support (e.g. 520A). Some embodiments also include one or more second rotation supports that are further recessed and/or angled relative to the first rotation supports (e.g. 522A.) The rest supports (e.g. 520A), the first rotation supports (e.g. 522A), and/or the second rotation supports (e.g. 524A) may have flat, angled, or curved surfaces.

FIG. 9A illustrates a variation in which a rest support 520A and a receiving section 538A are adjacent to each other, and each are adjacent to a first end 510A that has a magnetic support 518A. The receiving section 538A includes a first rotation support 522A and a second rotation support 524A. The first rotation support 522A is farther from the fourth end 516A than the rest support 520A. The second rotation support 524A is farther from the fourth end 516A than the first rotation support 522A. The second rotation support 524A is adjacent to the third end 514A.

This configuration permits a user to press at a side of a mobile device (e.g. FIG. 1 mobile device 146) that is near the third end 514A, causing the mobile device to rotate around an

axis parallel to the Y axis and perpendicular to a side of the mobile device mounting system **502A** that has the magnetic support **518A**.

FIG. 9B illustrates a variation in which a first end **510B** includes a magnetic support **518B**. A rest support **520B** is adjacent to the first end **510B**, and a receiving section **538B** is adjacent to the rest support **520B**. The receiving section **538B** and the rest support **520B** are both adjacent to the third end **514B** and the fourth end **516B**. The receiving section **538B** includes a first rotation support **522B** and a second rotation support **524B**. The second rotation support **524B** is farther from the first end **510B** than the first rotation support **522B**.

This configuration permits a user to press at a side of a mobile device (e.g. FIG. 1 mobile device **146**) that is near the second end **512B**, causing the mobile device to rotate around an axis parallel to the X axis and parallel to a side of the mobile device mounting system **502B** that has the magnetic support **518B**.

FIG. 9C illustrates a variation in which a rest support **520C** is disposed between a pair of first rotation supports **522C**. Both of the first rotation supports **522C** and the rest support **520C** are disposed between a first end **510C** and a second end **512C**. The first end **510C** includes a magnetic support **518C**. One of the first rotation supports **522C** is adjacent to the fourth end **516C**, and the other first rotation support **522C** is adjacent to the third end **514C**.

This configuration permits a user to press at a side of a mobile device (e.g. FIG. 1 mobile device **146**) that is near the third end **514C** or the fourth end **516C**, causing the mobile device to rotate around an axis parallel to the Y axis and perpendicular to a side of the mobile device mounting system **502C** that has the magnetic support **518C**.

FIG. 9D illustrates a variation that includes two merged receiving sections **538D**. One of the receiving sections **538D** is disposed farther from the magnetic support **118D** than the rest support **520D** along the Y axis. The other receiving section **538D** is disposed farther from the fourth end **516D** than the rest support **520D**.

This configuration permits a user to press at a side of a mobile device (e.g. FIG. 1 mobile device **146**) that is near the third end **514D**, causing the mobile device to rotate around an axis parallel to the Y axis and perpendicular to a side of the mobile device mounting system **502D** that has the magnetic support **518D**.

This configuration also permits a user to press at a side of a mobile device that is near the second end **512D**, causing the mobile device to rotate around an axis parallel to the X axis and parallel to a side of the mobile device mounting system **502D** that has the magnetic support **518D**.

FIG. 9E illustrates a variation that includes a receiving section **538E** that follows the perimeter of the mobile device mounting system **502E**. The rest support **520E** occupies a middle area, and is bordered on each side by the receiving section **538E**. A user is thus enabled to press the mobile device (e.g. FIG. 1 mobile device **146**) at any edge to cause the mobile device to be angled outward from the mobile device mounting system **502E**.

In other words, the user may press a side of the mobile device at an area that is not directly supported by the rest support **520E**. These areas may be between the rest support **520E** and one of the first end **510E**, the second end **512E**, the third end **514E**, and the fourth end **516E**. Pressing near one side of the mobile device with sufficient force causes the opposite side and/or corner to be elevated. For example, pressing near the third end **514E** elevates the side of the

mobile device near the fourth end **516E**. Pressing near the fourth end **516E** elevates the side of the mobile device near the third end **514E**.

Pressing the mobile device (e.g. FIG. 1 mobile device **146**) at a corner may raise the opposite mobile device corner and/or an edge distal to the corner being pressed. For example, pressing a corner of the mobile device at the corner of the first end **510E** and the third end **514E** may raise the corner of the mobile device located near the corner of the second end **512E** and the fourth end **516E**. The edge of the mobile device near the second end **512E** and/or the edge of the mobile device near the fourth end **516E** may also be elevated, depending on which corner of the mobile device is pressed.

FIG. 9F illustrates a variation that includes a receiving section **538F** that borders the rest support **520F** on three sides. In the embodiment as shown, the rest support **520F** is adjacent to the first end **510F**, which includes the magnetic support **518F**. The receiving section **538F** is between the rest support **520F** and each of the second end **512F**, the third end **514F**, and the fourth end **516F**.

When a user presses with sufficient force on a surface of the mobile device (e.g. FIG. 1 mobile device **146**) that is suspended above a part of the receiving section **538F**, the mobile device is rotated into the receiving section **538F**, which causes one or more distal edges and/or corners to be elevated.

The rotation of the mobile device may depend on the surface that it is being rotated around. For example, in the image as shown, the rest support **520F** has flat sides that cause the mobile device to be rotated parallel to one of the X axis or the Y axis. In other embodiments, angled or rounded surfaces of the rest support **520F** and/or the receiving section **538F** may enable rotation of the mobile device in other directions. For example, the rest support **520F** in other embodiments may include an angle edge that is angled at 45 degrees relative to the second end **512F** and the third end **514F**. The angled edge may permit a user to press the mobile device face above the corner of the receiving section **538F** between the third end **514F** and the second end **512F** to elevate the opposite corner of the mobile device.

#### E. Receiving Section and Supporting Section Variations

FIGS. 10A-10F illustrate cross-sectional views of different receiving sections (e.g. **638A**) and supporting sections, according to various embodiments.

FIG. 10A illustrates an embodiment of a mobile device mounting system **602A** with components that may be integrally formed or assembled from separate components. The embodiment includes a first end **610A** having a first mount extension **658A**, and a second end **612A** having a second mount extension **660A**. The first and second mount extensions (**658A**, **660A**) may form a framing border that is secured to a mounting surface such as a vehicle dashboard. As illustrated, the second end **612A** further includes a retaining flange **644A**.

The mobile device mounting system **602A** further includes a magnetic support **618A**, a rest support **620A**, a first rotation support **622A**, a first support surface **626A**, a second support surface **628A**, and a receiving section **638A** having a recessed area **640A**. The mobile device mounting system **602A** lacks a second rotation support (e.g. such as second rotation support **624D** in FIG. 10D).

A user may insert a mobile device **146** into the recessed area **640A** of the mobile device mounting system **602A**, and can then rotate the mobile device **146** until it is adjacent to the magnetic support **618A**. To resist outward movement of the

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end of the mobile device **146** that is distal to the magnetic support **618A**, the retaining flange **644A** may extend inward along the X axis from the second end **612A** toward the first end **610A**. In some preferred embodiments, the retaining flange **644A** may extend between 0.5 mm to 3 mm inward from an inner wall of the receiving section **638A**. The inner wall may be parallel to a plane that is defined by the X axis.

The recessed area **640A** of the receiving section **638A** is defined in part by the second support surface **628A**. In the embodiment as shown, the second support surface **628A** and the first support surface **626A** are parallel to the X axis. The edge of the first support surface **626A** acts as a fulcrum for rotation of the mobile device **146**. When the user presses on the mobile device **146** on a part of the mobile device that would overlap with the second support surface **628A**, the mobile device **146** is rotated around the fulcrum.

In FIG. **10B**, an alternate variation is shown that differs from the variation of FIG. **10A** by the form and positioning of the rest support **620B** and the second support surface **628B**, as well as the form of the recessed area **640B**. In FIG. **10B**, part of the rest support **620B** extends away from the magnetic support **618B** along the X axis, and extends over a part of the second support surface **628B**.

FIG. **10C** illustrates a variation of the mobile device mounting system **602C** that includes a first rotation support **622C** that has a second support surface **628C** that is angled relative to the first support surface **626C** of the rest support **620C**. The mobile device mounting system **602C** also includes a second rotation support **624C** that has a third support surface **630C** that is parallel to the first support surface **626C** and is defined by the Z axis.

The first support surface **626C**, the second support surface **628C**, and the third support surface **630C** form a continuous surface. The first support surface **626C**, the second support surface **628C**, and the third support surface **630C** are flat.

FIG. **10D** illustrates a variation in which the second support surface **628D** is angled with respect to the first support surface **626D**, and the third support surface **630D** is angled with respect to both the first support surface **626D** and the second support surface **628D**.

The first support surface **626D**, the second support surface **628D**, and the third support surface **630D** are each flat and together form a continuous surface. The second support surface **628D** is angled to permit the mobile device **146** to simultaneously rotate away from the first support surface **626D**, towards the second support surface **628D**, and towards being parallel with the second support surface **628D**.

FIG. **10E** illustrates a variation in which the second support surface **628E** is curved. As the mobile device **146** is rotated from a lowered position to an elevated/angled position, the fulcrum location is varied. The fulcrum location may vary between the closest edge and the farthest edge of the second support surface **628E** relative to the magnetic support **618E**.

FIG. **10F** illustrates a variation in which the rest support **620F** extends upward along the Z axis. The rest support **620F** may be a rod, a wall, or composed of a plurality of elongate members or walls. The first support surface **626F** is the upper surface of the rest support **620F**.

The first rotation support **622F** may extend from the base of the rest support **620F** along the X axis away from the magnetic support **618F**.

In some embodiments, the mobile device **146** may be capable of being rotated toward or away from the second support surface **628F** from a lowered position (e.g., a rest position or a held position). For example, if the retaining flange **644F** is smaller or is not present, the user may press the mobile device **146** at a location near the magnetic support

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**618F** at an area that would rotate the mobile device **146** upward or away from the second support surface **628F**.

The third support surface **630D** is angled to permit the mobile device **146** to continue rotating away from the first support surface **626D** and the second support surface **628D**, and towards the third support surface **630D** as well as towards being parallel with the third support surface **630D**.

#### F. Exemplary Method

FIG. **11** illustrates a flowchart of an exemplary method. In some embodiments, each of the operations are performed. In other embodiments, one or more of the operations are optional and/or may be performed in a different sequence.

In operation **1102**, using the magnetic support, the system engages the magnetic edge of a mobile device.

In operation **1104**, using the first rest support, the system supports the mobile device at a first contact surface during use by a user and while the mobile device is being held by the mobile device mounting system.

In operation **1106**, when the user presses on the mobile device at an area that would intersect the receiving section when projected through the mobile device along the third axis, the system receives a part of the mobile device when the mobile device is angled such that the magnetic edge of the mobile device is separated from the magnetic support.

In operation **1108**, using the second support surface, the system receives contact from a second contact surface on the rear side of the mobile device when the mobile device has been rotated toward the second support surface.

In operation **1110**, using the third support surface, the system receives contact from a third contact surface on the rear side of the mobile device when the mobile device has been rotated away from the first support surface and the second support surface and towards the third support surface.

While the foregoing written description of the invention enables one of ordinary skill to make and use what is considered presently to be the best mode thereof, those of ordinary skill will understand and appreciate the existence of variations, combinations, and equivalents of the specific embodiment, method, and examples herein. The invention should therefore not be limited by the above described embodiments, methods, and examples, but by all embodiments and methods within the scope and spirit of the invention.

In addition, although only some embodiments of the present invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within scope of this invention.

What is claimed is:

1. A mobile device mounting system configured to hold a mobile device having a magnetic edge, the mobile device mounting system comprising:

a rest support that extends in a first direction and a second direction normal to the first direction and is mechanically coupled to the magnetic support, the rest support having a rectangular profile defined between first and third parallel ends and second and fourth parallel ends and having a first support surface that contacts a first contact surface on a rear side of the mobile device when the mobile device is moved downward in a third direction that is perpendicular to the first direction and the second direction to be held by the mobile device mount-



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ing system for viewing, and the mobile device's magnetic edge is adjacent to and magnetically engaged with the magnetic support; and

a receiving section that is mechanically coupled to the rest of the first support surface along the third direction, the recessed area extending from one opposing end of the first through the fourth end to the other opposing end of the first through the fourth end, and being configured to receive a part of the mobile device when the mobile device is angled such that the magnetic edge of the mobile device is separated from the magnetic support.

2. The mobile device mounting system of claim 1, wherein the receiving section includes a first rotation support that has a second support surface that contacts a second contact surface on the rear side of the mobile device when the mobile device has been rotated toward the second support surface.

3. The mobile device mounting system of claim 2, wherein the second support surface is curved such that a part of the

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second contact surface that is in contact with the second support surface changes as the mobile device is rotated around the first rotation support.

4. The mobile device mounting system of claim 3, wherein the curve of the second support surface decreases in radius with increasing distance away from the first support surface.

5. The mobile device mounting system of claim 2, wherein the receiving section includes a second rotation support that is mechanically coupled to the first rotation support, the second rotation support having a third support surface that contacts a third contact surface on the rear side of the mobile device when the mobile device has been rotated away from the first support surface and the second support surface and towards the third support surface.

6. The mobile device mounting system of claim 1, further comprising:

a magnetic support that extends along the first direction.

\* \* \* \* \*